

1. **DxPre Specifications:** Unless otherwise stated within the comments (col 5 of the DxPre table), the criteria within the DxPre Table (Item 3) shall be met by retaining the trees described to be marked within the Leave Tree Guidelines (Item 2). The DxPre Specifications are met when the marking or cutting meets the DxPre Specifications.
2. **Leave-Tree Guidelines:** Italicized groups of words are defined in definitions portion of Attachment A.

Abbreviations; Rx= Silvicultural Prescription. i.e. HTH(thinning All HTH are from below d/D=.8), HSL (selection harvest) or combination of these. TPA = Trees per acre. BA = Basal area, expressed as square feet per acre (ft²/ac). SP= Species including PP (ponderosa pine), DF (Douglas-fir), WWP (Western white pine), LP (lodgepole pine), WL (western larch), WRC (western red cedar) ES (Engelmann spruce), GF (grand fir), WH (western hemlock), AF (alpine fir), QA(quaking aspen. DF Dwarf Mistletoe= Douglas-fir DMT.

Canopy Status	Tree Class	Leave Category	Crown Ratio	Crown Vigor	DF DMR	Bark Beetle Attacks	General Marking Guidelines
Overstory	1-A	Desirable	50% +	Healthy	< 1	None	Leave unless competing with larger 1-A tree.
	1-B	Satisfactory	35% +	Generally Healthy	< 2	Few and Unsuccessful	Leave unless competing with larger 1-B or 1-A tree.
	1-D	Undesirable	< 35%	Poor Health	> 2	Many or Successful	Cut as part of gap or leave as part of clump or ghost.
Understory	2-C	Acceptable	50% +	Healthy	< 1	None	Leave if not competing with 1-A or 1-B tree.
	2-F	Unacceptable	< 50%		> 0	Any	Cut unless wildlife tree.

I. Leave Tree Marking:

- A. The **stump mark** shall be a minimum size of 6 inches long and 2 inches wide. It shall be placed at the base of every leave tree and on the downhill side. Place in a crevice on downhill side, if one is available.
- B. A horizontal **band** at least 2" wide must encircle the tree between 5 feet and 7 feet above the ground.
- C. Paint marks shall be visible for a distance of at least 100' in all directions until harvest operations are complete.

II. Mark to leave:

- A. **ALL old trees**, as determined by scoring keys in *Identifying Old Trees and Forests in Eastern Washington* by Robert Van Pelt September 2008
http://www.dnr.wa.gov/ResearchScience/Topics/ForestResearch/Pages/lm_oldgrowth_guides.spx. Rating of 8 or higher for PP (page 90) and 9 or higher for DF (page 130). For GF, WRC, WH, and other species with no scoring key use individual species (pages 133-158). western white pine as determined by thick platy bark.
- B. **ALL Wildlife Trees** having a dbh $\geq 25"$: Trees with bird holes, large nests, live snags and trees with more cull material than sawlog material. Cull material defined as 51% or more of the tree does not contain 8 foot logs that are 40% sound.
- C. **ALL** PP having the most desirable (D1) characteristics. Trees with D1 characteristics do not have any indicator of disease or poor form and they are not crowded. These shall be retained regardless of stocking level.
- D. Generally leave all Mature trees with rating of 6-7 for PP and 7-8 for DF as determined using Van Pelt's key. Can remove as follows, otherwise clump:

DBH < 25": Younger age (< 150 yrs) Can remove if competing with old tree or larger 1-A or 1-B tree, otherwise clump.

DBH > 25": Can remove 1-D trees if competing with a larger old or mature 1-A/ 1-B tree, otherwise clump or ghost. Can remove 1-B tree if competing with old/ mature 1-A tree: 1-B tree is 20-21" and 1-A tree is Diameter +4".

- E. In order to meet the Stocking Level (Col. 3 of the DxPre Table) first mark trees defined as Most Desirable (D1) followed by trees defined as Less Desirable (D2).

1. Most Desirable Trees/Suitable: Trees that possess the following characteristics shall be the first choice for desirable leave trees:

- a. **Dominant and Co-dominant Preferred Species:** These trees are taller on the average when compared to other trees in the unit. The Preferred Species are in order of preference PP, WL, WWP, DF LP and WRC. WRC is not a preferred species in areas dominated by PP. When the preferred species does not possess desirable tree characteristics, *vigor/growth* is given preference.
- b. **Health:** With the exception of WL and WWP, foliage shall be dark green in color. The crown shall cover one third or more of the tree all the way around it. Healthy trees are free of *severe insect or disease problems* and are not stressed. See definition of Severe Insect or Disease Problems in Appendix A.
- c. **Straight Bole:** The bole or stem of the tree shall be relatively straight and have a single terminal leader.
- d. **Free of Physical Damage:** Trees shall not have physical damage from fire, animals or weather on more than one-fourth of the circumference of the bole or more than three feet of length of the bole.
- e. In addition to above described healthy dominant/co-dominant preferred species, healthy WWP > 4" dbh are also Most Desirable Trees.

2. Less Desirable Leave Trees also Suitable: When the average basal area of most desirable leave trees cannot be achieved with trees that possess the most desirable characteristics, the Contractor shall select trees with less desirable characteristics in the priority listed below:

- a. Minor Defect: Preferred species with minor defect such as a minor crook, a small amount of animal damage, or mistletoe < *Hawksworth rating 3*.
- b. Intermediate preferred species followed by dominate or co-dominate ES, WH, & GF having desirable tree characteristics.
- c. Intermediate non-preferred species (GF,WH,SAF,ES) having desirable tree characteristics. Intermediate trees are approx. ½ the height of dominate/co-dominate trees.
- d. Other Live Trees: Trees other than insect or disease damaged trees with at least 30% live crown and *height to diameter ratio* ≤ 1:100.
- f. Forked Trees: Those trees with two or more terminal leaders.
- g. Physical Damage: Trees that have physical damage on less than half the bole circumference and less than three feet in length. Physical damage may be caused by equipment, falling trees, lightning, wind, animals, etc.

III. Vary the Density:

- A. The characteristics of available trees shall determine stocking level at most locations.
- In areas with mandatory leave trees (described in II.A.B.C), the stocking level may be high. How high will depend on how many of these trees exist. In areas with Most Desirable trees the basal area may be 20-60 ft²/ac higher than required average providing only Most Desirable and mandatory trees are marked. The amount of required leave trees and Most Desirable Trees will determine how many Less Desirable trees should be marked.
- B. There may be units where the stocking level will not be achieved due to a lack of suitable leave trees. This is acceptable providing the suitable trees are marked to leave. Suitable trees are those with characteristics described in E1 or E2 (above). Unsuitable trees are described in IV (below).
- C. In general, retain a higher BA within mesic microsites and in stands dominated by WRC and WH; lower BA on dry sites within stands or dominated by DF and PP

IV. Leave Tree Marking: Do Not Mark A-I (below): An exception shall be made for required leave trees (II.A.B.C). Where clumps are required an exception would be made for E.

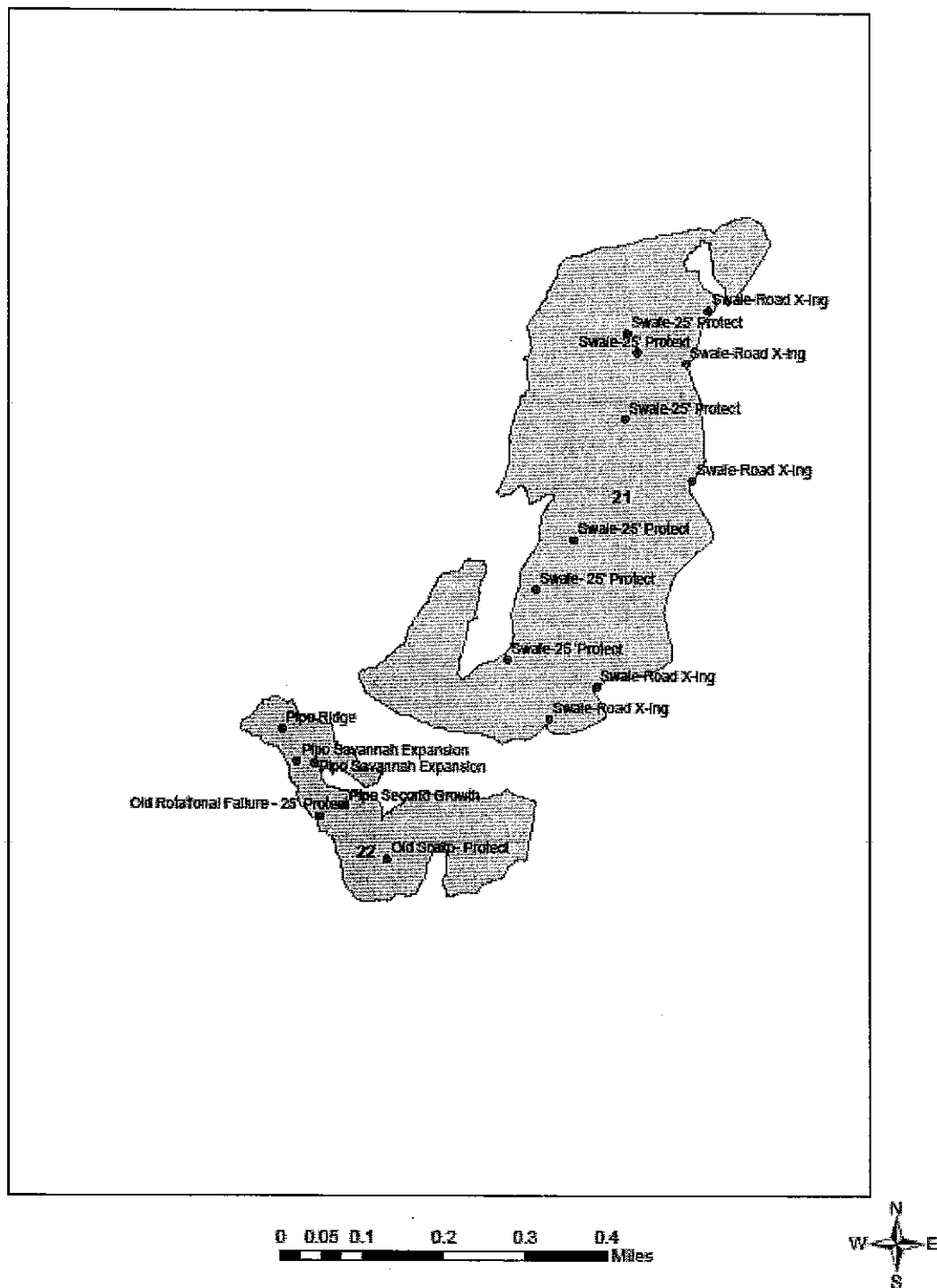
- A. Hardwoods, or trees < 7" dbh.
- B. Trees not expected to live for 10 years.
- C. Trees with *severe insect or disease problems*
- D. Species listed as Do Not Retain (Col 4).
- E. Other species within 30' (stem to stem) of healthy Dominant or Co-dominant PP, WL or WWP. This may be an individual or several of these species. i.e. Healthy PP, WL, WWP should be marked within 30' and beyond.
- F. WL and DF with a *Hawksworth Mistletoe rating* of 3 or more. See definition in Attachment A.
- G. Conifer trees with a poor *height to diameter ratio*. See definition in Attachment A.
- H. Trees within 50' of an *Aspen stands*.
- I. WRC in areas dominated by PP and/or DF (i.e. dry sites)

3. DxPre Table

Subdivision No. (Col 1)	Acres (Col 2)	Unit-average residual stocking (Col. 3)	Do Not Retain (Col 5)	Comments (Col. 6) *See Footnote																					
21	90	100 ft ² /ac	GF <30" dbh; except green culls can be counted as both a leave tree and as a wildlife tree.	<p>In addition to the Leave-Tree Guidelines: apply variable density thinning from below (d/D=.8) as described in General Marking Guide (Attachment C). Apply riparian, course woody debris and snag design criteria. Leave 2-3 clumps per acre. Site mostly dry.</p> <p>Irregular spacing should be dictated by pattern of existing dominant trees. Vary spacing as mosaic of site quality and tree diameter changes. Where tree diameters are ≥ 25-inches diameter breast height, retain up to 120 ft²; where tree diameters are ≤ 14-inches diameter breast height, tighten spacing to 70 ft².</p> <p>Existing blowdown/ windthrow is very heavy. Priority removal of dead and down green DF due to high levels of DF beetle activity.</p> <p>Older fire remnant legacy ponderosa pine exists on the overstory with an 80+ year age class of fire regeneration below it.</p> <p>Special Features: Buffer 25' Either side of swale. Top and bottom of the swales in the unit are flagged pink/black candy stripe.</p> <table><tr><th>Top of Feature</th><th>Lat.</th><th>Long</th></tr><tr><td>Dry Swale 1-21</td><td>47_46'_03.1"</td><td>120_41'_07.5"</td></tr><tr><td>Dry Swale 2-21</td><td>47_46'_01.9"</td><td>120_41'_06.5"</td></tr><tr><td>Dry Swale 3-21</td><td>47_45'_57.7"</td><td>120_41'_07.7"</td></tr><tr><td>Dry Swale 4-21</td><td>47_45'_46.7"</td><td>120_41'_15.9"</td></tr><tr><td>Dry Swale 5-21</td><td>47_45'_49.9"</td><td>120_41'_12.3"</td></tr><tr><td>Dry Swale 6-21</td><td>47_45'_42.3"</td><td>120_41'_18.5"</td></tr></table> <p>Watchouts: DF with DMT.</p>	Top of Feature	Lat.	Long	Dry Swale 1-21	47_46'_03.1"	120_41'_07.5"	Dry Swale 2-21	47_46'_01.9"	120_41'_06.5"	Dry Swale 3-21	47_45'_57.7"	120_41'_07.7"	Dry Swale 4-21	47_45'_46.7"	120_41'_15.9"	Dry Swale 5-21	47_45'_49.9"	120_41'_12.3"	Dry Swale 6-21	47_45'_42.3"	120_41'_18.5"
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22	23	90 ft ² /ac	GF <30" dbh; except green culls can be counted as both a leave tree and as a wildlife tree.	<p>In addition to the Leave-Tree Guidelines: apply variable density thinning from below (d/D=.8) as described in General Marking Guide (Attachment C). Apply riparian, course woody debris and snag design criteria. Leave 2-3 clumps per acre. Site mostly dry.</p> <p>Irregular spacing should be dictated by pattern of existing dominant trees. Vary spacing as mosaic of site quality and tree diameter changes. Where tree diameters are ≥ 25-inches diameter breast height, retain up to 120 ft²; where tree diameters are ≤ 14-inches diameter breast height, tighten spacing to 70 ft².</p> <p>Special Features: Buffer 50' Top of Scarp</p> <table><tr><th>Top of Feature</th><th>Lat.</th><th>Long</th></tr><tr><td>Scarp 1-22</td><td>47_45'_32.2"</td><td>120_41'_36.2"</td></tr><tr><td>Scarp 2-22</td><td>47_45'_29.5"</td><td>120_41'_29.7"</td></tr></table> <p>Watchouts: DF with DMT.</p>	Top of Feature	Lat.	Long	Scarp 1-22	47_45'_32.2"	120_41'_36.2"	Scarp 2-22	47_45'_29.5"	120_41'_29.7"												
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Timber Subject to Agreement				
23	248	120 ft ² /ac	GF <30" dbh; except green culls can be counted as both a leave tree and as a wildlife tree.	<p>In addition to the Leave-Tree Guidelines: apply variable density thinning from below (d/D=.8) as described in General Marking Guide (Attachment C). Apply riparian, coarse woody debris and snag design criteria. Leave 2-3 clumps per acre. Dry site.</p> <p>Irregular spacing should be dictated by pattern of existing dominant trees. Vary spacing as mosaic of site quality and tree diameter changes. Where tree diameters are ≥ 25-inches diameter breast height, retain up to 160 ft²; where tree diameters are ≤ 14-inches diameter breast height, tighten spacing to 70 ft².</p> <p>Wildlife- Goshawk timing restrictions apply. Botany- Two CYFA sites to protect.</p>

Low Pole Unit Reconnaissance Points



LOW POLE GENERAL MARKING GUIDE

Michelle Satterfield, Silviculturist,
May, 2013

This general implementation and marking guide was designed to be used with the unit prescriptions and the unit summary table.

Species abbreviations used throughout:

AF = subalpine fir
GF = grand fir
DF = Douglas-fir
ES = Engelmann spruce
LP = lodgepole pine
PP = ponderosa pine
RC = western red cedar
WH = western hemlock
WL = western larch
WP = western white pine

Table of Contents

Old Trees, Spatial Patterning, Live Crown Ratio (LCR)	2
Implementing Group Selection (See Figures 1 & 2 for photo examples).....	4
Implementing Commercial Thinning (See Figures 7 & 8 for preferred leave trees).....	4
Implementing Supplemental Marking (See Figure 7 for preferred leave trees).....	5
Implementing Untreated Patches	5
Implementing SKIPS (See Figure 5 for an example)	6
Implementing GAPS (See Figure 6 as an example)	7
Table Guidelines.....	8
Example Photos / Artwork	10
Definitions	14

LOW POLE GENERAL MARKING GUIDE

Old Trees, Spatial Patterning, Live Crown Ratio (LCR)

As Determined by scoring keys in *Identifying Old Trees and Forests in Eastern Washington* by Robert Van Pelt
September 2008

http://www.dnr.wa.gov/ResearchScience/Topics/ForestResearch/Pages/lm_oldgrowth_guides.aspx.

Retain ALL Old Trees: Rating of 8 or higher for PP (page 90) and 9 or higher for DF (page 130). For GF, WRC, WH, and other species with no scoring key use individual species (pages 133-158). Western white pine as determined by thick platy bark.

Mature Trees: Generally leave all Mature trees with rating of 6-7 for PP and 7-8 for DF as determined using Van Pelt's key. Can remove as follows, otherwise clump:

DBH < 25": Younger age(< 150 yrs) Can remove if competing with old tree or larger 1-A or 1-B tree, otherwise clump.

DBH > 25": Can remove 1-D trees if competing with a larger old or mature 1-A/ 1-B tree, otherwise clump or ghost. Can remove 1-B tree if competing with old/ mature 1-A tree: 1-B tree is 20-21" and 1-A tree is Diameter +4".

Spatial Patterning: To achieve desired spatial patterning, stands should include a combination of clumps, gaps, and complex patches (Figure 1). Incorporate into treatment prescriptions these three components of horizontal pattern:

1. **Clumps:**

- Clumps are defined as two or more trees in close enough proximity that their crowns are interlocking.
- Clump sizes should range from about 0.01 acres to 0.5 acres (Harrod et al. 1999).
- Vary the number of trees left in each clump.

2. **Canopy gaps/group openings:** These range in size depending on fire regime and occur on up to a third of the stand. In NEPA, HSL group openings are planned to be planted with fire tolerant tree species; openings need to be 3 to 5 acres each or in close proximity to be feasible and allow control of brush competition.

3. **Complex patches:** Complex patches are those with more structural and species complexity than the surrounding area. Patch characteristics include large snags, soft down logs, and mistletoe brooms. Utilize micro-sites, topography, and existing conditions to select locations to leave complex patches.

Non-Forest inclusions within units: Occasionally there will be small patches of non-forest or very low productivity forest land within units. These inclusions are variable in size and physical characteristics. Rock outcrops, tallus slopes, and shallow soils may be evident. In these areas no trees should be marked for removal within 30 to 50 feet of these areas

Plantations: "Blending" or softening edge to incorporate structural variations (edge effects) between existing young stands (plantations) and new treatment units is a key objective of treatments this entry.

Wildlife Trees: All snags that do not pose a safety hazard shall be retained unless otherwise agreed to in writing. Trees with bird holes or large nests (that can be safely operated around) should be retained regardless of other direction. See General Marking Guide for required minimums.

LOW POLE GENERAL MARKING GUIDE

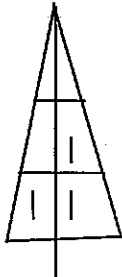
Select Trees: Where possible, remove all merchantable trees. Manage stand density retaining 40 to 70 square feet basal area of the largest diameter trees with the best physical traits within a one acre area surrounding the select tree.

Course Woody Debris and Down Logs: All dead down material is required to stay unless otherwise agreed to in writing. Recent down trees will be marked and cruised. December, 2012 storm created down and damaged Douglas-fir that will have priority for removal to reduce risk of Douglas-fir beetle killing large diameter or old Douglas-fir trees.

Untreated Patches or skips are untreated areas or no activity areas left to provide hiding cover for mule deer, buffer plants. Especially important are those legacies or stand structures that cannot be re-created in the managed stand. To help maintain long-term ecological diversity and other management objectives a number of areas are deferred from harvest treatment this entry and serve as a component of the retention of structural legacies.

Species Selection: Priority for removal is grand fir. The Contractor shall first retain preferred species having the largest and most *desirable tree* characteristics. When the preferred species does not possess desirable tree characteristics, *vigor/growth* is given preference. The preferred species for all DxPre Units are PP with over 40% live crown ratio, DF Largest with over 50% live crown ratio, WP Retain western white pine with no evidence of blister rust and successfully pitching out beetle and RC left as small group. Generally these 3 species have equal preference, over the remaining species (LP, ES, WH, and AF) with GF last. Red Cedar is an exception whose preference may vary depending on unique attributes of the area.

Priority for removal Douglas-fir with; a) Hawthorn Mistletoe rating of 3 or more (see diagram below). b) A height to diameter ratio $> 100:1$. For example a 50' height and a 6" dbh is 100:1 ratio. 60' height: 6" dbh is 120:1 ratio and should be removed. c) $< 25\%$ crown. Care should be taken in determination between epicormic branching and mistletoe.

 <p style="margin-top: 10px;">This example has a Hawthorn Rating of 3.</p>	<p>Hawthorn Mistletoe Rating is determined by dividing the crown of the tree into six parts as shown (left). Give each of the 6 parts 1 point if it has mistletoe. The sum of these parts equal the Hawthorn Mistletoe Rating.</p>
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LOW POLE GENERAL MARKING GUIDE

Implementing Group Selection (See Figures 1 & 2 for photo examples)

What is group selection? A regeneration cutting method designed to maintain and perpetuate a multi-aged structure by removing some trees in small groups. See Figures 1 & 2 for examples.

Table 1 Specifications for Group Selection

Attribute	Specification
Leave trees	<ul style="list-style-type: none"> • Leave all old trees. • Leave all <i>good vigor (healthy)</i> PP / WL / WWP (see Figure 7). • DO NOT Douglas-fir leave trees infected with dwarf mistletoe in the group selection areas.
Minimum size	• 2 acres (minimum size to ensure implementation success for planting)
Maximum size	• 5 acres (see Table 7 for a guide on determining size)
Minimum distance between group selection	• A width equal to two co-dominant / dominant tree heights.
Locations	• GPS the group selection locations > 2 acres to track them for site preparation and planting.

Placement - Select areas with one or more of the following conditions:

- *Poor vigor* trees (see Figure 7), which includes trees with: Live crown ratios <30%; Height-to-diameter ratios over 80 (tall, skinny trees – noodles); Chlorotic, fading or otherwise unhealthy crowns; and/or Dwarf mistletoe infection centers);
- *Aspen clones* that have 3 or more aspen trees;
- Widely spaced *good vigor* (see Figure 7), ponderosa pine (PP), and/or Douglas-fir (DF), western larch (WL), Western White Pine (WP) that are within an area of *poor vigor* trees;
- Grand fir or small cedar that are the result of past removal of large larch, Douglas-fir, or cedar (for example: you see large stumps, but the current stand is dominated by a lot of small subalpine fir); and / or

Marking

- Leave all old trees and all *healthy* PP. Ok to retain PP with Hawksworth's dwarf mistletoe ratings unless expected to die in next 10 years.'

Implementing Commercial Thinning (See Figures 7 & 8 for preferred leave trees)

Table 2 Specifications for Commercial Thinning (for use in units with basal area targets)

Attribute	Specification
Leave trees	<ul style="list-style-type: none"> • Leave all trees old tree. • Leave the best available trees per acre needed to meet the basal area / TPA target.
Desired leave trees	<ul style="list-style-type: none"> • <i>Dominant</i> and <i>co-dominant</i> crown classes (see Figures 7 & 8) • <u>1st priority</u>: Trees with <i>good vigor (healthy)</i>; <u>2nd priority</u>: Trees with <i>fair vigor</i> • Order of species preference: PP / WL > WP > DF > RC > ES > WH > LP > AF > GF
Basal area target or Trees per Acre (TPA) target	<ul style="list-style-type: none"> • Unit prescriptions list the basal area target or trees per acre target. (See Table 9 for a spacing / basal area tatum and see Table 12 for TPA / spacing tatum) • Basal area targets and TPA targets don't apply to: clearing zone around aspen and large PP / WL; Gaps used to address forest health issues.
Acceptable basal area range	• Basal area / TPA may vary within the unit by 50% but the unit average should be about what is specified as the target target. should be about 100 ft ² /acre.

LOW POLE GENERAL MARKING GUIDE

Implementing Supplemental Marking (See Figure 7 for preferred leave trees)

Supplemental Marking for Leave Trees

Objective: Supplement the DxD designations in order to:

- 1) Retain desirable trees that would otherwise be cut as the spacing designation is applied; and
 - 2) Retain occasional clumps of trees so the spatial pattern is similar to Figure 4.
- Desirable trees include all good vigor western larch and ponderosa pine. *Good vigor* Douglas-fir trees are desirable within units where there are abundant subalpine fir, cedar or lodgepole trees. Within some units desirable trees include *good vigor* western red cedar, Engelmann spruce, and subalpine fir. Unit prescriptions specify which trees to retain.
 - Use Figure 7 to help you judge whether the tree has *good vigor*.

Supplemental Marking for Cut Trees

Objective: Supplement the DxD designations in order to:

- 1) Cut undesirable trees that would otherwise be retained when the spacing designation is applied.
- Undesirable trees: *poor vigor* trees, especially ones with dwarf mistletoe infections.

NOTE: Assessing tree vigor of shade-tolerant species like RC/ES/AF/GF will be a little more difficult than for PP/WL/DF. Assess the tree's crown volume, overall appearance, and position relative to neighbors. Hint: Shade-tolerant trees beneath the deep shade of other shade-tolerant trees likely will not have good vigor.

Implementing Untreated Patches

Why leave untreated patches? Patches of untreated areas are left to provide hiding cover for mule deer.

Table 3 Specifications for Untreated Patches

Attribute	Specification
Leave trees	<ul style="list-style-type: none">• Leave the best available hiding cover for mule deer.
Minimum size	<ul style="list-style-type: none">• ½ acre
Maximum size	<ul style="list-style-type: none">• 1 acre (maximum size doesn't apply to areas excluded due to other reasons)
Target percent of NEPA unit	<ul style="list-style-type: none">• 10% of NEPA Unit• Areas that were excluded due to sensitive soils, wetland/riparian areas, or inoperability count toward the untreated patch target.
Locations	<ul style="list-style-type: none">• GPS the untreated patch locations to track them for the contract.

Placement – Place in areas with the following conditions (follow the order of priority until the target is met):

1. Mule deer hiding cover – this consists of small conifer trees and/or dense shrubs in patches about ½ acre or larger in size that hide 90 percent of an adult deer at a distance of 200 feet or less;
2. Patches of overstory western red cedar or Engelmann spruce; and/or
3. Single snags or groups of snags over 16" dbh. Use the untreated patches to protect large snags (>16" dbh).

To the extent practicable, **DON'T** place untreated patches within 100 feet of quaking *aspen clones* or within 50 feet of large (>21" dbh) ponderosa pine or western larch. Quaking aspen, PP, and WL do not tolerate crowding.

LOW POLE GENERAL MARKING GUIDE

Implementing SKIPS (See Figure 5 for an example)

What is a skip? Skips are small inclusions within a unit that is left unthinned.

Why use skips? Skips help to maintain some species diversity and structural diversity, both of which may be eliminated when contract clauses such as designation by spacing are used. Within some stands, Engelmann spruce and western red cedar naturally grow in clumps with 2 or more strata present. Designation by spacing reduces this natural clumpiness and usually creates one canopy layer. The Kettle Face landscape was below the historic range of variability for late structure in mesic stands. Eastside Screens direction is to move early and middle structure stands toward applicable late structure. Applicable late structure for stands with spruce and cedar would have a portion of these stands in clumps and multi-strata. The unthinned inclusions would also provide snag recruitment.

Table 4 Specifications for Skips

Attribute	Specification
Leave trees	<ul style="list-style-type: none"> Any – see preferences below.
Minimum size	<ul style="list-style-type: none"> 1/20th acre (see Table 10 for a guide on determining size)
Maximum size	<ul style="list-style-type: none"> ½ acre or as otherwise specified in the Unit's prescription (see Table 10 for a guide on determining size)
Targets	<ul style="list-style-type: none"> Try to get some dispersion of the skips throughout the unit Try to get a mix of sizes Be mindful of how skips could disrupt skidding patterns
Locations	<ul style="list-style-type: none"> GPS the skip locations if it will help to track them during the contract.

Placement – Place in areas with the following conditions:

1. Areas dominated by medium to large (16" dbh and larger) overstory RC / ES / AF (see Figure 5);
 - a. An area dominated by overstory RC / ES / AF is one where more than 70% of the overstory trees are RC / ES / AF.
2. Areas with large snags (>16" dbh);
3. Areas with large (>16" diameter) downed logs; and/or
4. Larger areas dominated by lodgepole pine.

To the extent practicable, **DON'T** place skips within 100 feet of quaking *aspen clones* or within 50 feet of large (>21" dbh) ponderosa pine or western larch. Quaking aspen, PP, and WL do not tolerate crowding.

LOW POLE GENERAL MARKING GUIDE

Implementing GAPS (See Figure 6 as an example)

What is a gap? A gap is a break in the canopy that results from harvest or tree death (small pockets of beetle kill, dwarf mistletoe, root rot, and/or storm damage). Harvest created gaps are just small group selections.

Why use gaps? Like skips, gaps also help provide structural diversity. Shrubs, grass, herbaceous, and small trees regenerate and/or reinvigorate in gaps. Additionally, putting in gaps helps to eliminate and/or reduce disease issues that contribute to fuels buildup. A designation by spacing contract clause would not address the small pockets of diseased trees – in fact, designation by spacing could result in leaving heavily mistletoe infected trees over smaller but healthier trees.

Table 5 Specifications for Gaps

Attribute	Specification
Leave trees	<ul style="list-style-type: none"> • Leave all trees above 21" dbh. • Leave all <i>good vigor (healthy)</i> PP / WL. • In mesic units where DF / RC / ES are not abundant in the overstory, leave all of the good vigor trees of these species within the gap.
Minimum size	<ul style="list-style-type: none"> • No minimum size
Maximum size	<ul style="list-style-type: none"> • 2 acre or as otherwise specified in the Unit's prescription (see Table 11 for a guide on determining size)
Minimum distance between gaps	<ul style="list-style-type: none"> • A width equal to two co-dominant / dominant tree heights. • Note: co-dominant / dominant trees in the project area generally average 80 to 110 feet in height, so in most cases the minimum distance between gaps will be about 200 feet.
Sideboards	<ul style="list-style-type: none"> • Unit prescriptions specify the maximum percentage of the unit that can be in gaps.
Locations	<ul style="list-style-type: none"> • GPS the gap locations if it will help to track them during the contract.

Placement – Place in areas with the following conditions:

- Dwarf mistletoe infection centers – sometimes dwarf mistletoe is isolated to infection centers instead of dispersed throughout a unit;
- Large (>21" dbh) Douglas-fir infected with dwarf mistletoe that are surrounded by shorter Douglas-fir – placing a gap around these large trees would isolate them and help to reduce spread throughout unit;
- Patches of tall and skinny trees (wet noodles) – these are prone to storm damage. These tall, skinny trees will have poor live crown ratios (These are all of the trees designated "D" in Figure 7);
- Root disease centers; and
- Patches of mature lodgepole pine.

LOW POLE GENERAL MARKING GUIDE

Table Guidelines

Table 6 Guide for determining size of regeneration harvest size

Acres	Dimensions (square) Length x Width in feet		Acres	Dimensions (square) Length x Width in feet
2 ac.	~300 feet x 300 feet		9 ac.	~630 feet x 630 feet
3 ac.	~360 feet x 360 feet		10 ac.	~660 feet x 660 feet
4 ac.	~420 feet x 420 feet		11 ac.	~690 feet x 690 feet
5 ac.	~470 feet x 470 feet		12 ac.	~720 feet x 720 feet
6 ac.	~510 feet x 510 feet		13 ac.	~750 feet x 750 feet
7 ac.	~550 feet x 550 feet		14 ac.	~780 feet x 780 feet
8 ac.	~590 feet x 590 feet		15 ac.	~810 feet x 810 feet

Table 7 Example of how clumping of leave trees affects average leave tree spacing in a shelterwood

SHELTERWOOD										
Target leave trees per acre	20 Trees per Acre (TPA)									
Number of trees per clump	1	2	3	4	5	6	7	8	9	10
Spacing in feet	47	66	81	93	104	114	123	132	140	148

Note: Bottom line = when you *clump* you need to widen your spacing. It is unacceptable to leave trees at a uniform spacing of 47 feet – doing that would cause too much dispersed shade.
Shaded area = desired clumping in shelterwood areas that don't have 20 TPA of good vigor PP / WL / DF.
**Good vigor PP / WL / DF usually won't be in clumps larger than 4 trees.*

Table 8 Basal area / Spacing Tatum Aid for Commercial Thinning

Use this table as a guideline and vary spacing up to 50% to leave the largest, healthiest trees											
BA/ac	60 sq. ft.		70 sq. ft.		80 sq. ft.		90 sq. ft.		100 sq. ft.		BA/ac
Leave- tree dbh	Avg. Spacing	Avg. TPA	Avg. Spacing	Avg. TPA	Avg. Spacing	Avg. TPA	Avg. Spacing	Avg. TPA	Avg. Spacing	Avg. TPA	Leave- tree dbh
Inches	Feet	#	Feet	#	Feet	#	Feet	#	Feet	#	Inches
22"+	44	23	41	27	38	30	36	34	34	38	22"+
20"	40	28	37	32	34	37	32	41	31	46	20"
18"	36	34	33	40	31	45	29	51	28	57	18"
16"	32	43	29	50	28	57	26	64	25	72	16"
14"	28	56	26	65	24	75	23	84	22	94	14"
12"	24	76	22	89	21	102	20	109	20	109	12"
10"	20	109	20	109	20	109	20	109	20	109	10"

Note: Spacing guideline shows a minimum spacing of 20 feet minimize logging damage.
 Spacing (ft) = $(43,560/N)^{.5}$, N = BA/.005454D², N = trees per acre, BA = basal area per acre, D = diameter at height.
 When spacing between trees of different diameter classes, average the spacing distance; e.g., 16" and 10" dbh:
 (28 ft + 18 ft)/2 = 23 ft spacing

LOW POLE GENERAL MARKING GUIDE

Table 9 Sizes of SKIPS (radius in feet and acreage)

Radius of skip (ft)	Size in acres
25	0.05 (~1/20 th)
35	0.10 (~1/10 th)
60	0.25 (~1/4 th)
85	0.50 (~1/2)
Note: in stands where an orange painted tree designates a 25 foot not cut zone, one orange painted tree would result in a 1/20 th acre skip (the minimum skip size)	

Table 10 Sizes of GAPS (radius in feet and acreage)

Radius of gap (ft)	Size in acres
50	0.20 (~1/5 th)
60	0.25 (~1/4 th)
70	0.35 (~1/3 rd)
85	0.50 (~1/2)
100	0.75 (~3/4)
120 (maximum size)	1 acre
Note: in stands where a yellow painted tree designates a 50 foot cut zone, one yellow painted tree would result in a 1/5 th acre skip.	

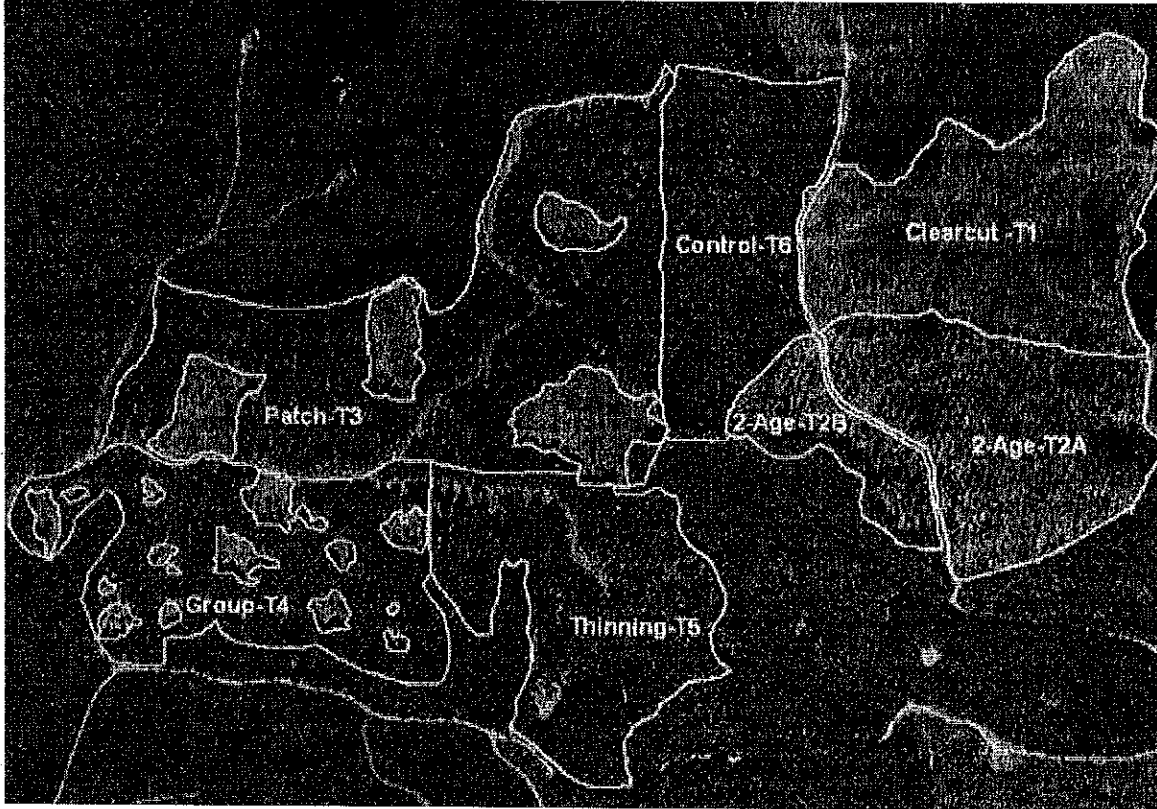
Table 11 Trees per acre / Spacing Tatum

Target Trees per Acre (acceptable range)	Average Spacing for Unit in feet	Acceptable Range of Spacing in feet*
30 (15-45 TPA)	38'	31-54'
40 (20-60 TPA)	33'	27-47'
50 (25-75 TPA)	30'	24-42'
60 (30-90 TPA)	27'	22-38'
70 (35-105 TPA)	25'	20-38'
80 (40-120 TPA)	23'	20-35'
90 (45-135 TPA)	22'	18-31'
100 (50-150 TPA)	21'	17-30'
110 (55-165 TPA)	19'	16-27'
*Note: minimum spacing for the range can be closer where trees are in a clump or when leave the best available tree.		

LOW POLE GENERAL MARKING GUIDE

Example Photos / Artwork

Figure 1: Example of different silvicultural methods: **Group-T4** = group selection (photo shows openings up to 1.5 acres); **2-age-T2A/B** = shelterwood with reserves (photo shows 15 trees per acre in uniform distribution); **Patch-T3** = patch cutting (photo shows openings 1.5 to 5 acre); **Thinning-T5** = commercial thinning. *Note: our group selection is sort of a fusion of the group selection and patch cutting shown in this photo.



LOW POLE GENERAL MARKING GUIDE

Figure 2: Graphic of group opening size determination with relatively tall tree heights.

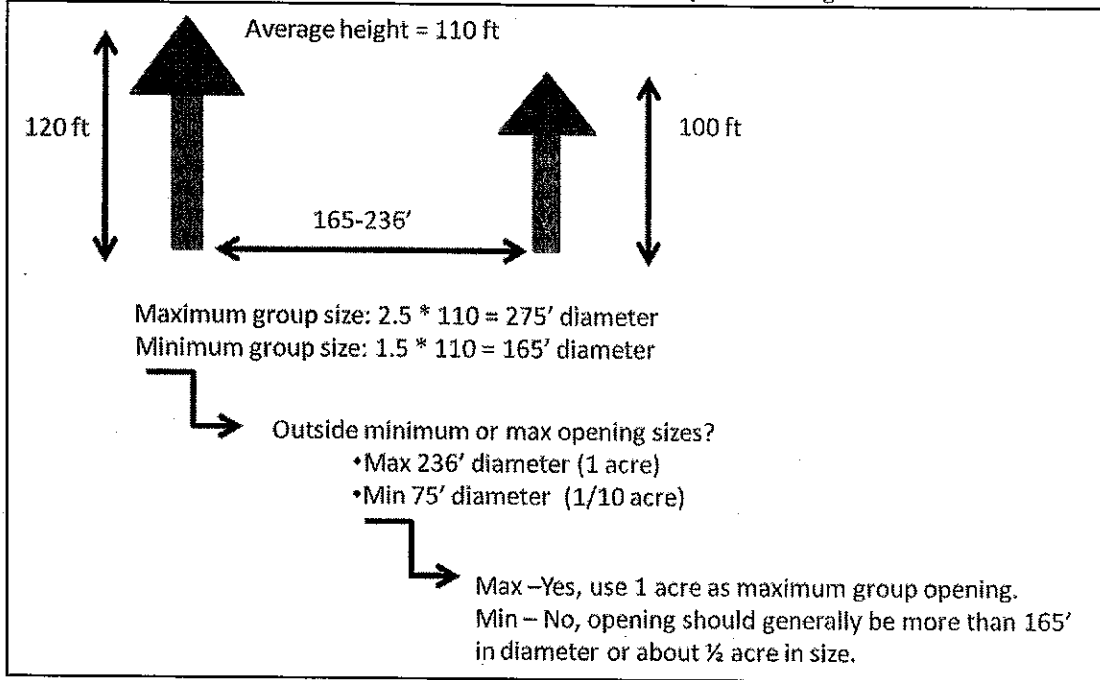


Figure 3: Example of shelterwood unit. Portions of the variable density marking will look similar. Some of the trees are about 100 feet apart, which resulted in some 1/2 acre gaps without trees. This photo was taken in fall (notice how just a few trees can shade a lot of the ground).



LOW POLE GENERAL MARKING GUIDE

Figure 4: Examples of desired and unacceptable leave tree spatial patterns in Shelterwood areas.

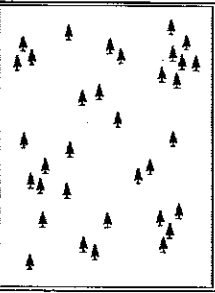
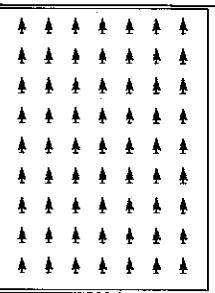
DESIRED SPATIAL PATTERN Variable with clumps & gaps	UNACCEPTABLE SPATIAL PATTERN Uniform
	

Figure 5: The area in the dashed box provides an example of a good candidate for a SKIP within a cedar stand. The trees in the artwork are western red cedar and western hemlock (artwork by Robert Van Pelt 2008) – to make this figure work for our area, imagine in your mind's eye that the darker colored trees are subalpine fir or Engelmann spruce.

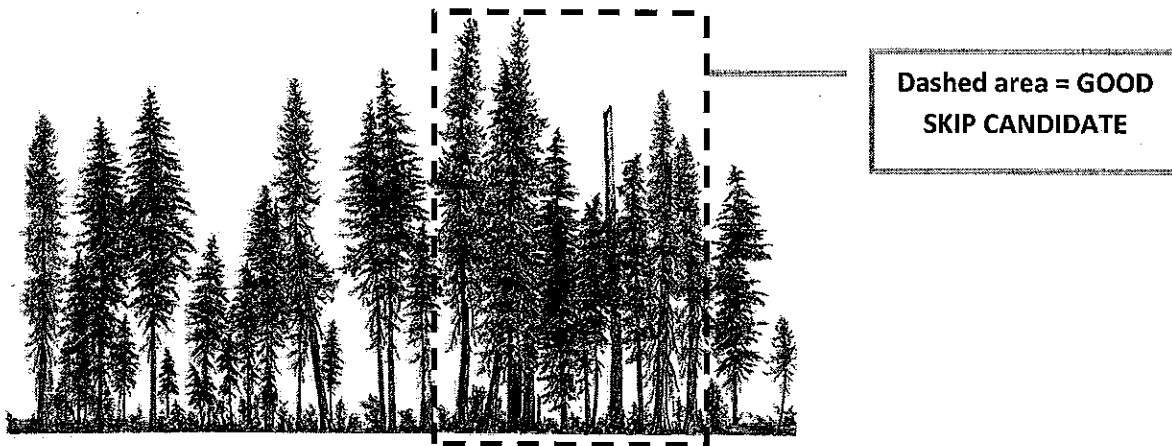
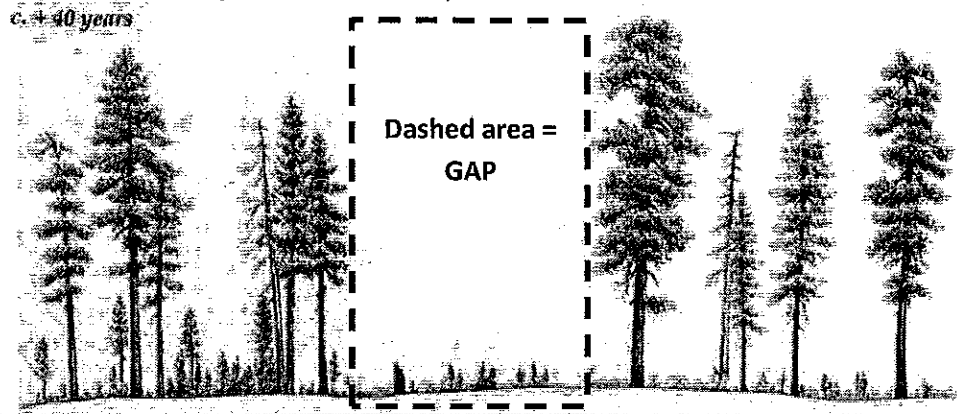





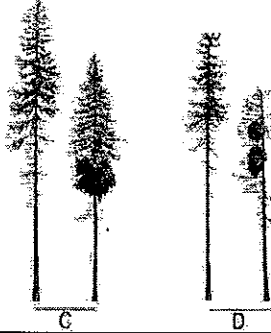


Figure 6: The area in the dashed box provides an example of a GAP. The artwork represents a dry stand with ponderosa pine and Douglas-fir (artwork by Robert Van Pelt 2008).



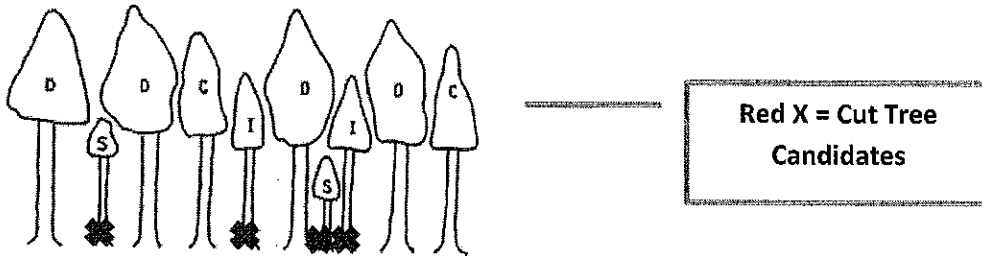
LOW POLE GENERAL MARKING GUIDE

Figure 7: Examples of vigor classes. Artwork by Robert Van Pelt 2008.

	PREFERRED LEAVE TREES A = good vigor B = fair vigor to good vigor <i>(usually dominant / co-dominant)</i>	CUT TREE CANDIDATES C and D = poor vigor <i>(usually suppressed / intermediate)</i>
Ponderosa pine		
Western larch		
Douglas-fir		
NOTE: Artwork not available for other species – use this artwork along with crown volume to judge vigor of other species.		

LOW POLE GENERAL MARKING GUIDE

Figure 8: Examples of crown classes. D = dominant; C = co-dominant; I = intermediate; S = suppressed. Red X = easy cut tree candidates.



Definitions

Aspen Clones – three (3) or more live aspen trees greater than 5.0 inches dbh (6.0 inches diameter stump height) that are within 20 feet of each other.

Canopy gap – sky is visible overhead because of space between tree crowns. Example: for there to be a gap of 35 feet between canopies the distance between tree trunks might be as wide as 50 feet.

Chlorotic – the foliage is yellowish or pale green in color.

Clump – two or more trees with touching or near touching crowns.

Crown Class – a category of tree based on its crown position relative to those of adjacent trees. Types of crown class are the following:

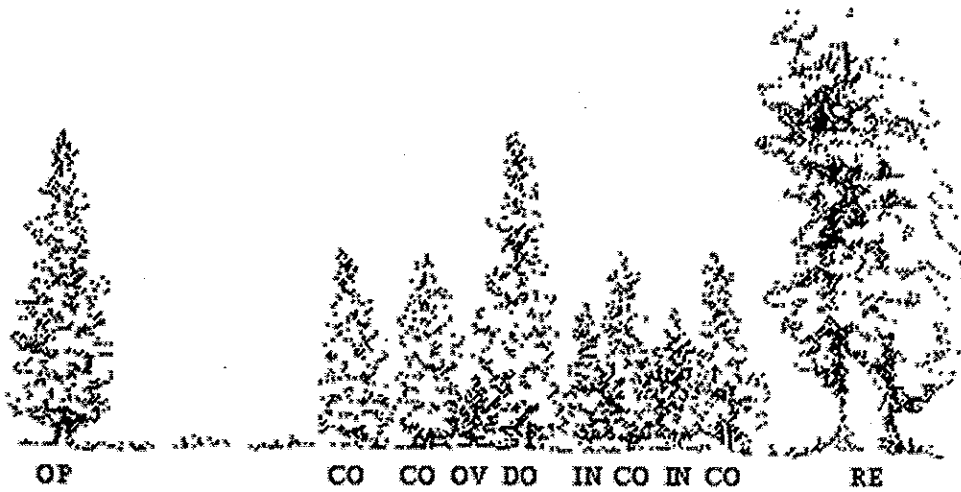
Codominant – a tree whose crown helps to form the general level of the main canopy in even-aged stands or, in uneven-aged stands, the main canopy of the tree's immediate neighbors, receiving full light from above and comparatively little from the sides.

Dominant – a tree whose crown extends above the general level of the main canopy of even-aged stands or, in uneven-aged stands, above the crowns of the tree's immediate neighbors and receiving full light from above and partial light from the sides.

Intermediate – a tree whose crown extends into the lower portion of the main canopy of even-aged stands or, in uneven-aged stands, into the lower portion of the canopy formed by the tree's immediate neighbors, but shorter in height than the codominants and receiving little direct light from above and none from the sides.

Suppressed (overtopped) – a tree whose crown is completely overtopped by the crowns of one or more neighboring trees — note the vigor of overtopped (suppressed) trees varies from high to low depending on individual circumstances.

LOW POLE GENERAL MARKING GUIDE

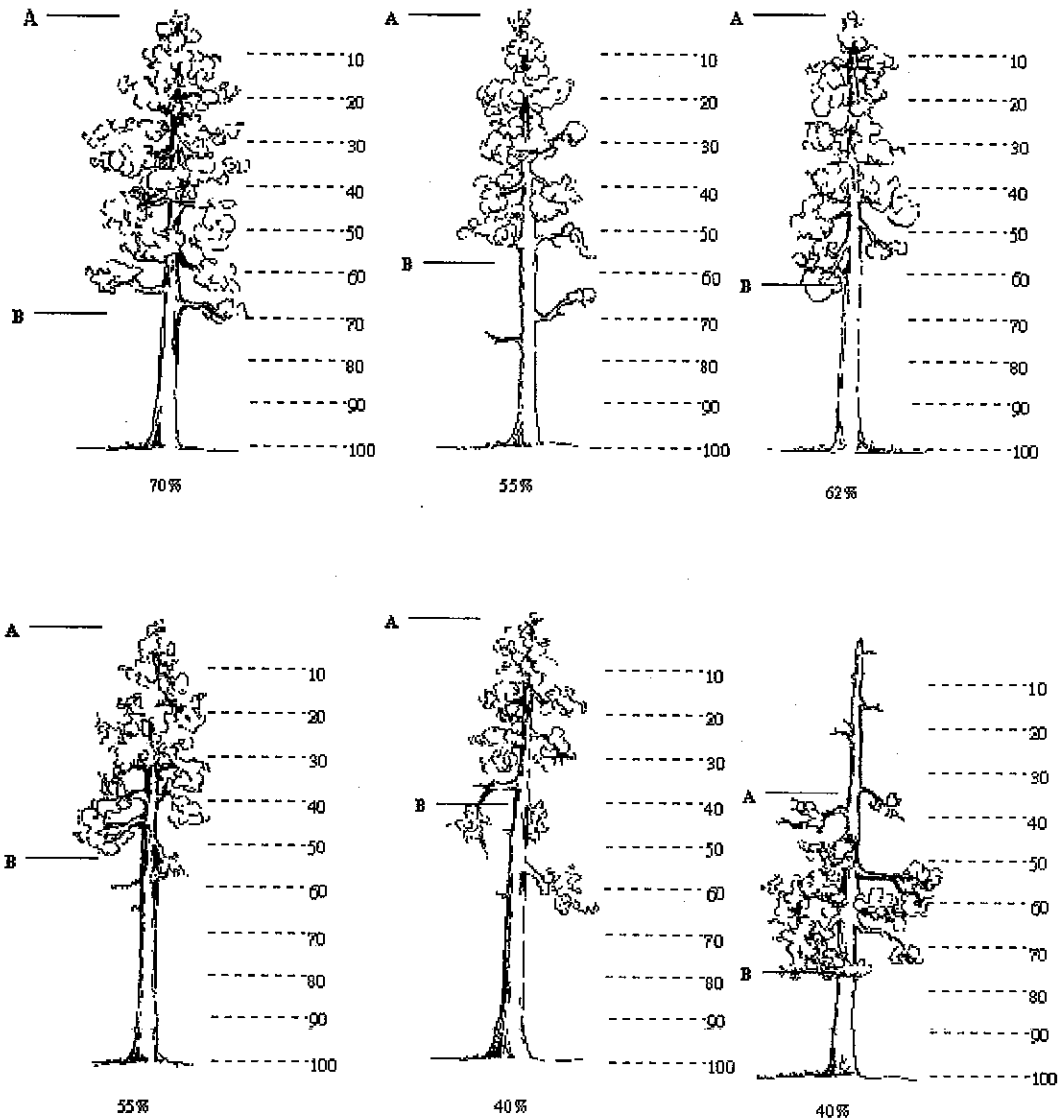


Damaged – trees with physical damage such as bark missing from the trunk or evidence of beetle attack (as evidenced by frass or boring dust).

Diseased – trees with dwarf mistletoe, root disease (as evidenced by bleeding base or fading crown), or other disease condition.

Live Crown Ratio (LCR) – the ratio of live crown length to tree height.

LOW POLE GENERAL MARKING GUIDE



Crown ratio is the portion of the tree bole supporting live, healthy foliage and is expressed as a percent of the actual tree height. The distance between A and B is the existing crown length.

Shade-tolerant Trees – Shade-tolerant species are species that are able to thrive in the shade, and in the presence of natural competition by other plants. Examples include: western red cedar, Engelmann spruce, grand fir, and subalpine fir.

Vigor (see Figures 7 & 8 for examples)

Poor Vigor – trees with one or more of the following: <30% LCR, fading or chlorotic crowns, Hawkworth's dwarf mistletoe rating of 3 or greater, root disease, successful bark beetle attack, and/or height-to-diameter (HT'/DBH') ratios greater than 80 (tall, skinny trees or noodles).

Fair vigor – trees with >30% LCR, free of root disease, and free of dwarf mistletoe infections (or with Hawkworth's dwarf mistletoe rating of 2 or less).

Good vigor (healthy) – trees with healthy appearing crowns, >40% LCR, and free of damage and disease.

**LOW POLE
GENERAL MARKING GUIDE**

LOW POLE GENERAL MARKING GUIDE

General Tree Marking Guide

Objective: Retain a residual stand of fire tolerant tree species, stand structure and size to restore forest complexity and resilience to fire.

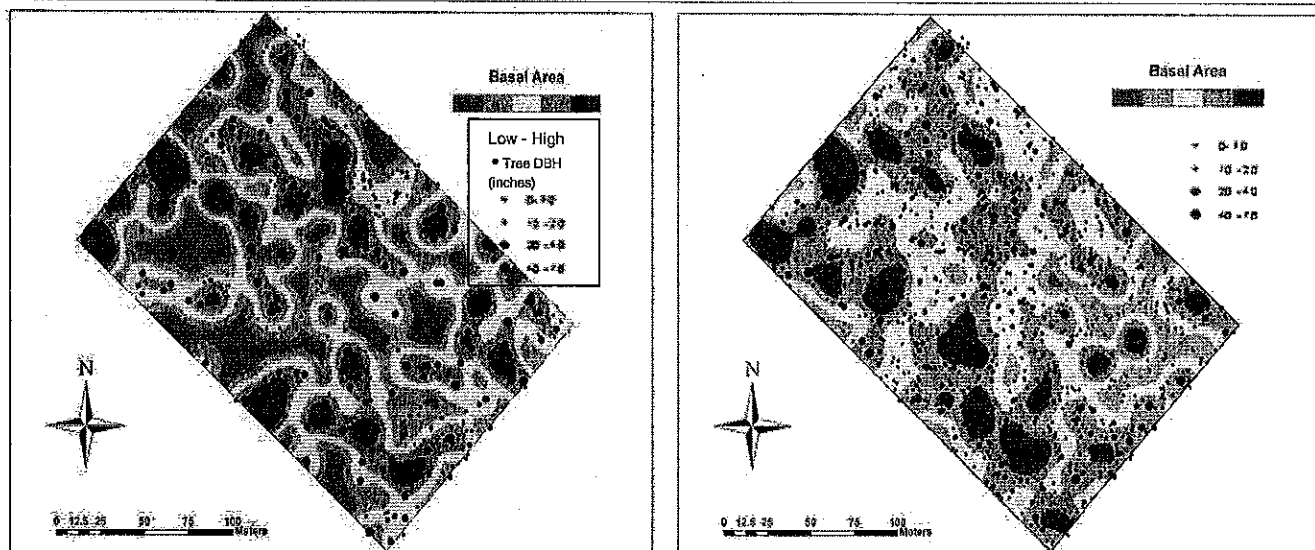
On June 17, 2010 the Okanogan Wenatchee National Forest established a Large and Old Tree Policy for all Fiscal Year 2011 Timber Sales and Stewardship Contracts. The interim direction provides guidance for defining large and old trees, and for achieving desired spatial pattern and density. It is in the Draft version of the Okanogan-Wenatchee NF Restoration Strategy.

Using historical stands as a guide to move toward spatial patterns for restoring forest complexity and resilience to fire, the **Commercial Thinning** prescription will primarily be a variable density thinning from below ($d/D=.8$)¹ emphasizing irregular spacing by creating gaps/openings & groups or clusters of trees/clumps (size & number based on historical stand data and existing stand conditions), among group variation (thin to variable basal area/SDI/ density targets) and within group variation (retain largest/"best" trees regardless of crown spacing). Forest structure is un-even at the landscape level; composed of single layer, even-aged stands or patches. Densities are approximations and would vary around the target densities. Retention and growth of large fire tolerant tree species (PP, DF) is emphasized. On dry sites the residual stand will be primarily ponderosa pine and Douglas-fir at an average of 33-67 trees per acre in groups of trees and individual trees and openings moving toward the 1929 spatial patterns. On mesic sites and microsites with dry sites target basal area will be between 50 and 125 square feet per acre. There will be 30 to 80 residual trees per acre that range from 23 to 38 feet in spacing. Grand fir has priority for removal. Target basal area will be between 50 and 125 square feet per acre. There will be 30 to 80 residual trees per acre that range from 23 to 38 feet in spacing. Grand fir has priority for removal.

The **Selection System, Uneven-aged Management** prescription the target basal area will be between 90 and 125 square feet per acre. Grand fir has priority for removal. There will generally be 30 to 80 residual trees per acre that range from 38 to 23 feet in spacing. Grand fir has priority for removal. The northern units of Low Pole are productive mesic sites.

Figure 1: Example of Basal area heterogeneity (Erick E Knapp et al, Pacific SW Research Station, 2009 Methods of Cutting Study, Stanislaus-Tuolumne Experimental Forest established 1929)

2008



¹d= Average diameter of tree cut. D= Average diameter of the stand.

LOW POLE GENERAL MARKING GUIDE

Table 1: Target stocking levels for hot-dry and warm-dry sites

Average diameter of residual trees contributing to target stocking	Target SDI	Approximate range of average trees per acre	Average range of basal area per acre
7 to 12 inches	60	50 to 60	30 to 40 ft ²
13 to 18 inches	60 to 70	30 to 40	50 ft ²
19 inches and larger	80 to 90	30 to 80	60 to 80 ft ²

On **average dry sites** (PP and/or DF dominant overstory trees) the target basal area will be between an average of **40 and 80** square feet per acre. There will generally be an average range of 30 to 50 residual trees per acre with spacing quite variable based on existing stand conditions, location of large trees, clumps, gaps and complex patches. Thinning from below would usually remove 40 to 60 percent of the existing basal area from fully stocked stands. Most dominant trees of the desired species would be retained. Usually some codominant trees would be retained to meet density targets. Target stocking level for hot-dry warm-dry sites is stand density index (SDI) 60-90. On **moderate more productive sites** **microsites** the average basal area per acre retained would increase, **generally 80 to 120 square feet per acre**. **Canopy gaps** (openings) would range in size depending on fire regime and occur on up to a third of the stand. **Clumps** are defined as two or more trees in close enough proximity that their crowns are interlocking. Clump sizes should range from about 0.01 acres to 0.5 acres (Harrod et al. 1999). Clumps of old large diameter trees would be retained at existing SDI providing adjacent area are reduced to achieve overall density objectives. The sizes of clumps retained would vary within the unit. **Complex patches** are those with more structural and species complexity than the surrounding area. Patch characteristics include large snags, soft down logs, and mistletoe brooms. Utilize micro-sites, topography, and existing conditions to select locations to leave complex patches. In some stands, complex patches are not present and time will be required for them to develop.

The target stocking level for more productive warm-mesic and cool-dry sites is stand density index (SDI) 80-120. Target average basal areas will be 70 to 90 square feet per acre. The desired range of vigorous conifer stocking by size class for these types of sites is displayed in the following table:

Table 2: Target stocking level for more productive warm-mesic, mesic series/transitional and cool-dry sites

Average diameter of residual trees contributing to target stocking	Target SDI	Approximate range of average trees per acre	Average range of basal area per acre
7 to 12 inches	80 to 90	70 to 90	40 to 50 ft ²
13 to 18 inches	100	40 to 70	60 to 70 ft ²
19 inches and larger	110 to 120	30 to 40	80 to 90 ft ²
Mesic Series DF/GF transitional	110 to 190	30 to 80	90 to 125 ft ²

Priority for selection of leave trees based on existing pattern, tree health, species composition:

- 1) Keep all **old** trees (thick bark/deep furrows, often established before 1900/generally >150 years at least 20" in diameter) Van Pelt book *Identifying Old Trees and Forests in Eastern Washington*, September 2008. http://www.dnr.wa.gov/ResearchScience/Topics/ForestResearch/Pages/lm_oldgrowth_guides.aspx.
 - a. Rating of 8 or higher for PP (page 90) and 9 or higher for DF (page 130). For GF, WRC,WH, and other species with no scoring key use individual species (pages 133-158). Western white pine as determined by thick platy bark.
 - b. Retain (unthinned) clumps of old trees and large/old tree structure and defective trees in grouped/clumped or clustered arrangement. In these clumps, if some ponderosa pine trees are

LOW POLE GENERAL MARKING GUIDE

smaller diameter but same cohort (disturbance), retain as part of clump. Acre density targets can be exceeded providing adjacent patches are reduced by the same amount.

- c. Retain all PP ≥ 30 -inches DBH.
- 2) ALL PP having the most desirable (D1) characteristics. Trees with D1 characteristics do not have any indicator of disease or poor form and they are not crowded. These shall be retained regardless of stocking level.
- 3) Grand fir has priority for removal.
- 4) Emphasize retention of the existing large tree (≥ 28 " dbh in Low Pole) component while meeting fuel objectives and target densities.
 - a. Maintain 12-15 trees per acre of the largest conifers available with the best form and vigor by considering growth, dbh, height, and live crown ratio, with the least amount of mistletoe, mechanical damage, or defect.
 - b. Vary tree clump/cluster size (number of trees) from 1 to 10+ within units to retain combinations of small, moderate, large and even groups of trees using existing locations of old trees and retaining replacement clumps of younger trees.
 - c. Give PP enough room (generally ≥ 25 -28" dbh in Lowpole Project Area). To OPEN UP AROUND OLD AND LARGE INDIVIDUAL PP consider fuel ladder and trees ability to survive fire disturbance. Taking out younger (<150 year old) dominant/codominant DF is an option if the young/large DF has a long crown and would be a fuel ladder. Old and or large DF would be left nearby if the PP is released on three sides and the DF does not have a fuel ladder (a fuel ladder would include dead or live crown within 10-feet of ground). Remove most UNDERSTORY TREES (ladder fuels and moisture competitors) that are within about 1 to 2 driplines of large diameter ponderosa pine trees- this includes all grand fir and excess Douglas-fir that are not old.
- 5) CREATE SPATIAL PATTERN OF LEAVE TREES: Irregular spacing is desired. Densities are approximations and would vary around the target densities. Leaving the largest diameter trees with the healthiest crowns is more important than spacing. Dominant PP or DF with healthy live crowns (full green needles, LCR > 50%) should only be marked for cutting where too many of them exist relative to the prescribed density targets.
 - a. CLUMPS are several trees in close proximity with interlocking crowns. For diversity within the unit and to retain character of the natural stand, clumps of 2 to 10+ trees closely spaced (1' to 8' apart), patches of healthy regeneration or clumps of old trees would be left. Trees that fork below DBH count as two trees; leave both or take both trees forked below DBH. When a clump is selected to retain do not thin mature (>20 " dbh, age 150+) PP or mixed PP/DF. Feature the largest diameter trees with the healthiest live crown ratios where possible.
 - b. In CANOPY GAPS (fewer than about 0-5 TPA) created opening between 1/10 to 1 ac will be created and occur on up to a third of the stand. Examples of gaps include: patches of intermediate trees (especially DF); patches of closed canopy trees where LCR <35% especially when near remnant PP; patches of unhealthy regeneration (latent dmt, etc); where DF mistletoe or root rot buffers are create, etc.
 - c. COMPLEX PATCHES are those with more structural and species complexity than the surrounding area. Patch characteristics include large snags, soft down logs, and mistletoe brooms. Utilize micro-sites, topography, and existing conditions to select locations to leave complex patches. In some stands, complex patches are not present and time will be required for them to develop.
- 6) Because inter-tree spacing is not a primary criterion, the resulting stand can be quite variable. VARY residual density thinning targets by species, site stockability, microsite (dry or mesic), and objective. At the stand scale, the density target should leave the majority of dominant trees in good condition. Outside clumps, open residual trees up on all sides so that no crowns are touching.
- 7) THIN FROM BELOW retaining enough of the largest trees (usually the next oldest cohort) with live crown ratios (LCR) ≥ 35 % to meet the density objective. Favor BEST LIVE CROWN RATIO.
 - a) Ponderosa pine needs a minimum of 40 percent live crown to be competitive in mixed conifer stands. In areas where existing ponderosa pine have less than 40 percent live crown ratio, leave trees if needle length is long and live crown volume is high (dense foliage).
 - b) Largest Douglas-fir with over 50% live crown ratio.

LOW POLE GENERAL MARKING GUIDE

- 8) OPEN RESIDUAL TREES UP SO THAT CROWNS ARE NOT TOUCHING.
- 9) Priority for selection of cut trees: GF has priority for removal. Overtopped and suppressed trees of all species, PP with LCR <25%, DF with LCR <20%, DF DMT rating >4, Trees with active bark beetle attacks, DF and GF with fading crowns adjacent to root disease infections.
- 10) CONFINE Douglas-fir dwarf mistletoe. Isolate or kill in place infected old Douglas-fir and isolate retained infected young Douglas-fir. At the margin of removed or retained trees, a dwarf-mistletoe free zone (DMZ) would be created by removing most apparently clean Douglas-fir for up to 50 feet. This would be to remove trees with incipient, undetectable infection.
- 11) GF has priority for removal. CONFINE Grand Fir leave trees to wet areas or moist upland microsites, upland transition from flood-plains, usually clumped, to individuals mixed with DF. GF are thin bark and susceptible to low-intensity fires and units are scheduled for prescribed fire. Van Pelt page 133-144 Figure 125 for upper crowns of old grand fir.
- 12) Don't discriminate against trees with POOR FORM until about 5% of the residual stand has poor form. A healthy forked tree is better than a small codominant tree or an understocked clump. When too many nice dominant trees are present, and then discriminate against the tree with poor form.
- 13) LAMINATED ROOT DISEASE Laminated root rot centers would contain 3 or more adjacent symptomatic trees. Multiple tree laminated root rot centers have a much greater potential to contribute to disease spread than single tree infections. Where laminated root disease centers exist, designate for removal all Douglas-fir and grand fir within 50 feet of trees killed by or with crown symptoms of laminated root.
- 14) Retain wildlife trees. These are retained mistletoes infected trees, live trees with dead, broken, forked tops or obvious sign of use. Retain in small clumps when possible.
- 15) Mark to facilitate yarding and cutting. Do not mark to cut "branch bound" trees. If trees are forked below DBH and clearly part of the same root collar leave both or cut both.
- 16) In areas where the leave tree diameters are 4.0" to 8.0" DBH use a Diameter + 8 foot spacing. PP 18 to 20 foot spacing combined with leaving some in clumps.
- 17) Retain all HARDWOOD TREES. Reduce conifer encroachment in aspen clones and promote clone expansion. Most conifers, estimated to be less than 100 years of age or less than 20" dbh, would be removed within about 75 feet of existing ASPEN stands to help reverse conifer encroachment and allow aspen expansion.
- 18) Retain a few of each of the existing tree species that occur in the stand.

NON-FOREST INCLUSIONS WITHIN UNITS: Occasionally there will be small patches of non-forest or very low productivity forest land within units. These inclusions are variable in size and physical characteristics. Rock outcrops, tallus slopes, and shallow soils may be evident. In these areas no trees should be marked for removal within 30 to 50 feet of these areas.

SELECT TREES: Protect all Select Trees from logging and yarding damage and fire treatments. Remove or modify ground and ladder fuels adjacent to the select tree to increase chance of survival in the event of a wildfire or during site preparation burn activities.

Leave trees should have **GOOD GENETIC QUALITIES:** Good diameter and height growth evidenced by dominance and codominance within a particular age group; evidence of resistance to insects and pathogens, few branches per whorl with little or no branching between whorls.

Where they exist, retain all healthy and moderate quality western white pine.

Example of Marking: Retain a mix of basal areas (20 ft² to 90 ft²) leaving clumps of trees combined with individual tree selection. Create irregularly shaped group opening (¼ to 5 acres in size) where dead/dying or poor quality trees exist. Average residual basal area will vary between 60 ft² (areas poor quality leave trees or insects/disease) and 80 ft² (areas where the manageable component is good condition).

General Tree Marking Guide For Selection Harvest

Individual tree vigor should determine retention priority. The removal of selected trees from specified size and age classes over the entire stand in order to meet a predetermined goal of size or age distribution and species composition in remaining stand. The result of this treatment is a fully stocked stand that exhibits a variety of

LOW POLE GENERAL MARKING GUIDE

stocking density, and may have small openings created where a new crop of seedlings will become established. Cutting methods that develop and maintain uneven-aged stands are Single Tree Selection - The removal of selected trees from specified size and age classes over the entire stand in order to meet a predetermined goal of size or age distribution and species composition in the remaining stand; Group Selection - The removal of small groups of trees to meet a predetermined goal of size distribution and species in the remaining stand. Up to 50 percent of the existing trees would be harvested in each unit, with up to 25 percent emphasizing regeneration objectives using group openings. This treatment will move early structural stage stands to middle, or maintain stands as middle structure by allowing the understory to develop or be released by treatment. Similar to the HTH, this treatment will accelerate the growth of the residual overstory trees moving the stand more rapidly toward late structural stage.

This silvicultural system calls for conversion of even-age stands over an 80 year time frame, putting 25% of the area in a regeneration status every 20 years. The remaining portions of the stands receive an improvement cut with each entry. Openings provide for regeneration large group openings 3 to 5 acres in size or small group openings less than 1½ acres in size. Individual tree selection will be used in stands with an existing uneven-age size class distribution. Opening less than 2 acres in size promote shade tolerant vegetation.

General Tree Marking Guide For Regeneration Harvest

Forest Plan standards and guides (C-41) require that about 15% of the area associated with each regeneration unit would be retained as standing green trees. Outside of unit to be marked, about 70% of these trees would be retained in unharvested patches (GTR) of at least one half acre, unit size permitting. About 30% of these trees would be left as scattered green trees (5 to 10 TPA) within the unit. This even-age regeneration system cuts the majority of the stand. Retain all old trees.

Where available, large leave (20"+dbh) trees help create a more complex stand structure in the new stand while also helping to soften the visual impact. Favor fire tolerant species and those with thick bark that could with stand a fire. If available, approximately five to ten trees per acre of the larger, healthier ponderosa pine, and if necessary, larger, healthier (disease-free) Douglas-fir, would be retained. Lodgepole pine can be retained in small groups (2-5 trees) or as individuals if windfirm. Where insufficient dominant/codominant leave trees exist, based on logging system design, site preparation needs, and topography, small groups of trees may be left.

Some dwarf mistletoe infected trees over 20" dbh would be retained in clumps of more than 2 or 3. Isolated individuals would generally be removed to prevent widespread infection of Douglas-fir regeneration. To protect susceptible tree regeneration from dwarf mistletoe infection, placement of mistletoe leave trees would be along lower edges of unit or stressed or killed by a variety of methods (leaving slash levels adjacent to tree, torching large broom near ground, varying lighting patterns to help kill or stress the tree to increase susceptibility by secondary agents) to minimize spread.

Snag Recruitment

The desired future condition is to retain snags and down wood at levels within the natural range of variability to contribute to the viability of species dependent on this habitat.

Table 1: Snag Density Retention Levels (landscape level natural range of variability)

	Snag Size (dbh – in)			
Land-use Allocation	10-14	15-19	>20	Total
Dry Forest Type				
Matrix	1.2	1.1	0.9	3.2
LSR/MLSA	2.8	2.0	1.3	6.1
Mesic Forest Type				
Matrix	3.0	2.2	0.7	5.9
LSR/MLSA	9.3	2.0	1.7	13.0

LOW POLE GENERAL MARKING GUIDE

The largest snags with the best longevity should be retained for wildlife trees. An obvious hazard tree (logger safety) should not be counted toward meeting snag targets.

Favor leaving Douglas-fir snags greater than 28-inches DBH over beetle killed PP less than 28-inches DBH. Favor retaining a mix of dead trees, dead topped trees, green trees with dead/decayed parts or severely deformed trees.

Green Douglas-fir with large DMT brooms and limb deformities can be used for wildlife trees. Leave isolated from other DF trees to limit spread of infection. DO NOT retain in regeneration units (refer to unit marking guide for exceptions where it is desired to kill most of these trees by prescribed fire). If torching is desired (wildfire or underburn) pile fuels to promote severely stressing or promoting secondary attacks to kill the tree before susceptible regeneration is approximately 4.5 feet in height.

When possible retain old persistent snags (no bark) and consider lighting methods, protection buffer or pullback. Low vigor trees that will die soon can be used for wildlife trees, especially those with low commercial value such as grand fir with heavy Indian paint (cull) or evidence of woodpecker or nest use.

Grouping of snag recruitment trees is preferred over marking individual trees. Groups should be spaced no further than 5 acres apart. In some stands laminated root disease centers can be left to serve for snag recruitment. An unthinned green tree buffer can be left to reduce logger safety concerns. This would work well where lodgepole pine or ponderosa pine surrounds the root rot pocket.

Down Material

In dry forest, an average of at least 3 to 10 tons per acre would be retained. In mesic forest, an average of at least 5 to 10 tons per acre would be retained. Logs greater than 10 inch diameter and greater than 16 feet long would be counted, as well as standing dead trees expected to fall in the short term.

Preference for logs left un-harvested are those of large diameter and those which have large, intact root wads that are of little risk to developing a brood of bark beetles.

Existing down logs, snags and green wildlife recruitment trees should meet down log goals of 160 linear feet per acre, providing down logs are not bucked and piled to reduce fuels. The majority of the fuels treatment is leave tops of trees attached (LTA) removing most of the larger down material to landing piles. Care should be taken to maintain down material to ensure long term site productivity; not over simplify the forest floor; and to retain these structural elements to incorporate into the managed stand.

Buffers Adjacent to Sensitive Plant Populations

Marking for plant buffers has been done within units. Should additional plants be found during marking of unit, make contract inspector or COR aware of locations.

Aquatic Conservation Areas- Riparian Reserves

Unit layout would address known streams. Should a stream be located during layout apply the following buffers:

For Intermittent Streams: There would be no silvicultural treatment or planned ignition within one "drip line" on the outside edge of the inner gorge, or within 50 feet of the stream channel.

For Perennial Non-Fish Bearing Streams: No silvicultural treatment or planned ignition would occur within 50 feet of these streams to maintain vegetative ground cover and prevent erosion next to the stream.

For Fish Bearing Streams: No silvicultural treatment or planned ignition would be allowed within 100 feet of fish bearing streams. Treatment would be precluded within the inner 100 feet of the reserve to maintain vegetative ground cover and prevent erosion next to the stream.

LOW POLE GENERAL MARKING GUIDE

Basal Area/Spacing Tatum Aid:



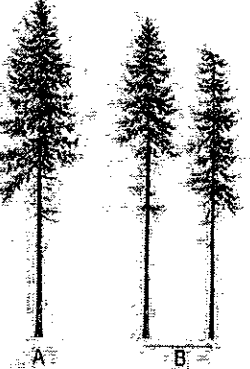



BA/ac	60 sq. ft.		70 sq. ft.		80 sq. ft.		90 sq. ft.		100 sq. ft.		110 sq. ft.		120 sq. ft.		BA/ac
Leave-tree Dbh	Bole-to-bole Spacing	Average # Trees per Acre.	Bole-to-bole Spacing	Average # Trees per Acre.	Bole-to-bole Spacing	Average # Trees per Acre.	Bole-to-bole Spacing	Average # Trees per Acre.	Bole-to-bole Spacing	Average # Trees per Acre.	Bole-to-bole Spacing	Average # Trees per Acre.	Bole-to-bole Spacing	Average # Trees per Acre.	Leave-tree Dbh
In.	Ft.	#	Ft.	#	Ft.	#	Ft.	#	Ft.	#	Ft.	#	Ft.	#	In.
22"+	44'	23	41'	26	38'	30	36'	34	34'	38	32'	42	31'	45	22"+
20"	40'	27	37'	32	34'	37	33'	41	31'	46	29'	50	28'	55	20"
18"	36'	34	33'	40	31'	45	29'	51	28'	57	26'	62	25'	68	18"
16"	32'	43	29'	50	28'	57	26'	64	25'	72	24'	79	23'	86	16"
14"	28'	56	26'	65	24'	75	23'	84	22'	94	21'	103	20'	112	14"
12"	24'	76	22'	89	21'	102	19'	115	18'	127	18'	140	17'	153	12"
10"	20'	110	18'	128	17'	147	16'	165	15'	183	15'	202	14'	220	10"
8"	16'	172	15'	201	14'	229	13'	258	12'	287	12'	315	11'	344	8"
6"	12'	306	12'	357	10'	408	10'	459	9'	510	9'	561	8'	612	6"
5"	10'	441	9'	515	9'	588	8'	662	8'	735	7'	809	7'	882	5"

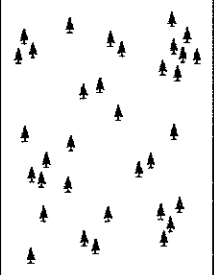
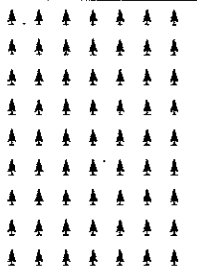
A silviculturist shall be available to marking crew to provide guidance. Sample plots shall be taken and documented as part of the prescription card. The check plots should include leave species, DBH, crown diameter, purpose of leave tree (e.g. snag recruitment, down log, etc.). If contracted, Contractor is responsible for meeting target densities. Track all trees >20" marked to leave.

Michelle Satterfield, Silviculturist

February 2013

LOW POLE GENERAL MARKING GUIDE

	PREFERRED LEAVE TREES A = good vigor B = fair vigor to good vigor	CUT TREE CANDIDATES C and D = poor vigor
Ponderosa pine		
Douglas-fir		
Western larch		
NOTE: Leave all old (≥ 150 years) remnant trees regardless of vigor. Retain PP0 >30" dbh. Use this artwork along with crown volume to judge vigor of other species.		

DESIRED SPATIAL PATTERN Variable with clumps & gaps	UNACCEPTABLE SPATIAL PATTERN Uniform
	

LOW POLE GENERAL MARKING GUIDE

Source: Smith 1962. - MODIFIED

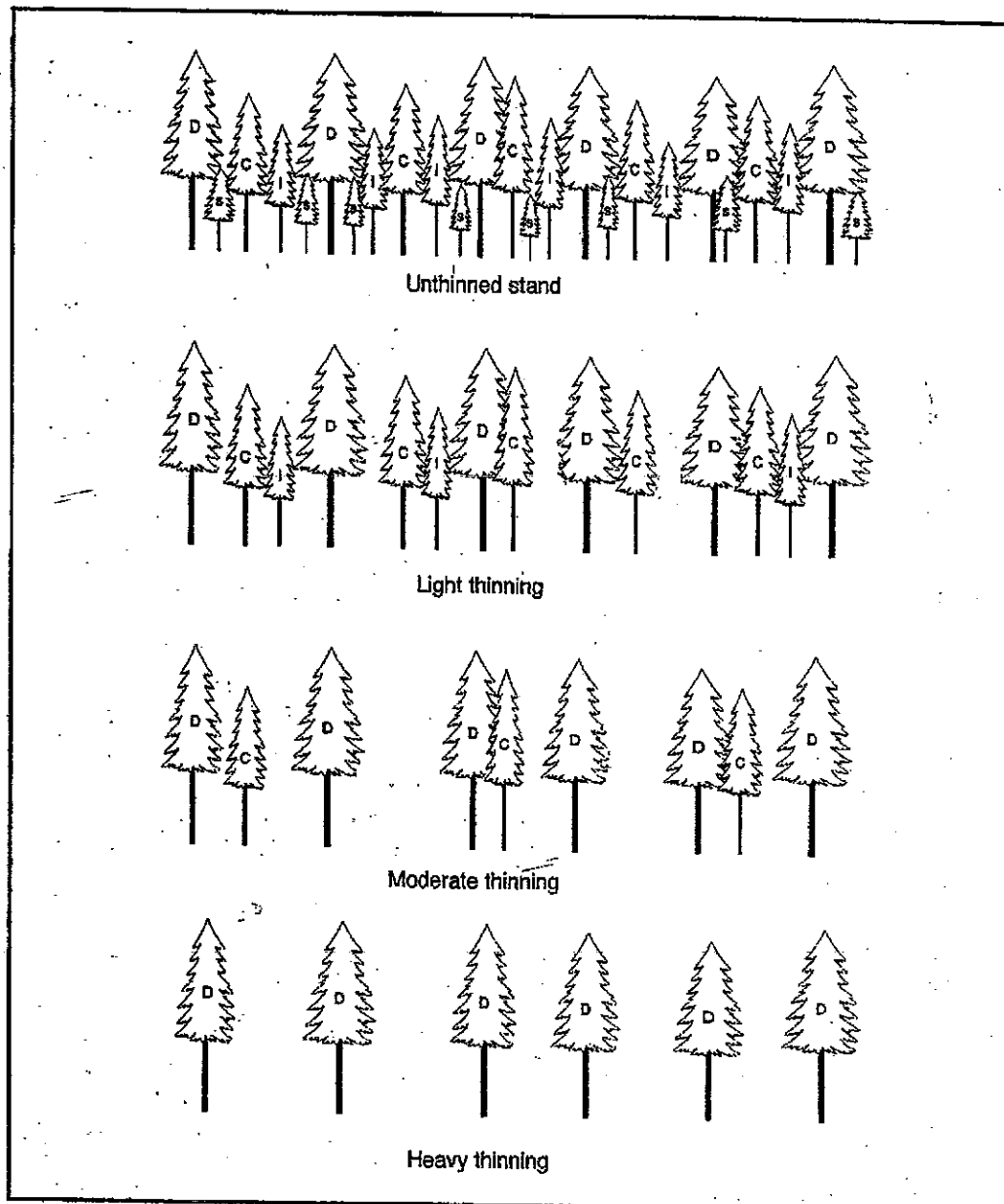


Figure 1—A conifer stand containing a mixture of dominant (D), codominant (C), intermediate (I), and suppressed (S) trees thinned from below (low thinning) to three different intensities.

THINNING FROM BELOW & CROWN CLASS GRAPHIC

LOW POLE GENERAL MARKING GUIDE

Mapped Spotted Owl Critical Habitat to retain 60% Canopy Cover

